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SCIENCE

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ASAPH HALL

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PROFESSOR ASAPH HALL, one of the most noted of American astronomers, died on November 22 at the home of his son, Professor Angelo Hall, at Annapolis, Maryland, and was buried at Goshen, Connecticut, in the family cemetery on November 25.

Asaph Hall was born in Goshen, Conn., October 15, 1829. His ancestors were among the early English settlers of New England and their names appear in the records of the colonial wars and of the revolution. His grandfather, Asaph Hall, was a captain of the company organized at Cornwall, Conn., which assisted in the defense of Ticonderoga. His father, Asaph Hall, married Hannah Palmer, of Goshen, Conn., and Professor Asaph Hall, who has just died, was the eldest of six children by this marriage.

He received such early education as the youth of his time had access to at the country school and at Norfolk Academy and, after he had become of age, attended college at McGrawville, N. Y. There he met Angeline Stickney, a student and teacher of mathematics at that college, whom he subsequently married and who, throughout her life, gave herself devotedly to him and to his scientific work. Professor Hall's choice of astronomy was largely due to her suggestion and she was the first perhaps to recognize his unusual mathematical ability. After their marriage, they went to Ann Arbor, Mich., where Mr. Hall studied under Brünnow, the well-known

astronomer, at that time director of the Ann Arbor Observatory.

Professor Hall's career as an astronomer began at the Harvard Observatory, under William Bond, in 1857. His work there consisted mainly in the routine observatory work, but he quickly became an expert in the computation of the orbits of comets and began to show the admirable grasp of mathematical relations which later on made him an authority in problems of gravitational astronomy.

In 1862 he entered the Naval Observatory as assistant astronomer and in 1863 was appointed professor of mathematics in the United States Navy by President Lincoln, a position which he retained until retired, under the regulations, in 1891, on the completion of his sixty-second year.

The thirty years which Professor Hall spent at the Naval Observatory were full of fruitful work, both as an observer and in the higher sphere of mathematical investigation of astronomical phenomena. From 1862 to 1866 his work was that of assistant observer with the 9½-inch equatorial, then considered a very large instrument, and consisted in the main of observations of asteroids and comets. In 1867 he was in charge of the meridian circle; from 1868 to 1875 in charge of the 9½-inch equatorial; and from 1875 to 1891 in charge of the 26-inch equatorial, at the time of its erection the largest refracting telescope in the world. During these years he was the leader in many expeditions to distant parts of the world to conduct observations of special interest. In 1869 he went to Bering Strait to observe an eclipse of the sun; in 1870 to Sicily to observe an eclipse; in 1874 to Vladivostock to observe the transit of Venus, the voyage being made on the *Kearsarge*. In 1878 he had charge of an expedition to Colorado to observe the eclipse of the sun in that year;

and in 1882 he went to Texas to observe the transit of Venus.

The contributions of Professor Hall to astronomy were so numerous that a mere enumeration of them would fill a long catalogue. Working astronomers have been familiar with his papers in the *Astronomische Nachrichten*, that universal journal of astronomical communication, for half a century.

His first discovery with the 26-inch equatorial, which was of great interest, was a white spot on the planet Saturn in 1876, by means of which a new and accurate determination of the rotation period of the planet was made.

In the summer of 1877, at the time of the near approach of the planet Mars, he made a systematic search for new satellites, which was rewarded by the most interesting discovery with which his name is connected, that of the two satellites Deimos and Phobos. Up to that time it had been believed that Mars had no moons and the discovery of two companions of this comparatively well-known planet, one of them revolving around the planet in a period less than one third of the revolution time of the planet itself, came to astronomers almost as an unwarranted innovation in the solar system. The investigation of the inner satellite has led to the most interesting results in the study of the evolution of planets and their satellites.

Next to these brilliant telescopic discoveries, the discovery of the motion of the line of the apsides of the orbit of Hyperion, one of Saturn's satellites, was perhaps Mr. Hall's most remarkable piece of work.

His long and systematic observations with the great equatorial at Washington were of special value, not only for the great accuracy with which they were made, but also for the admirable way in which they were joined to the work of other observers and made as nearly as possible comparable

with them. Perhaps no observer in any nation, unless it be Otto Struve, has contributed so long and valuable a series of observations with a single equatorial as is embraced in the work of Professor Hall.

This work lay mainly in three directions: first, planetary observations, consisting in the main of determinations of the positions of the satellites, with the consequent investigations of their orbits; second, observations of double stars with numerous investigations of the double star orbits; third, determinations of the stellar parallax. In each of these fields of astronomical activity Mr. Hall's work was of the highest value and led not only to interesting observational results, but to most elegant discussions of gravitational problems in the solar and stellar systems. His observations, in particular, of the system of the planet Saturn, including those of the rings, have been of primary importance in bettering our knowledge of that interesting planet.

In all this work Professor Hall showed not only a high order of skill as an observer, but he also developed a very high order of ability in his grasp of those mathematical relations involved in the treatment of the gravitational problems of our system of planets and satellites. His papers concerning the various problems arising out of the motions of planets and satellites brought him his highest recognition and showed him to be a man possessing an order of intellectual ability of exceptional character. It is not too much to say that he is one of a group of Americans of not more than a half dozen men at most who have attained high rank as mathematical astronomers.

The recognition of Professor Hall's work by various societies and governments is most significant of the character of the work itself. He received the gold medal of the Royal Astronomical Society of London, the Lalande prize of France, the

Arago medal from the French Academy of Sciences, and was made a knight of the Legion of Honor. He was a member of the more important scientific societies in this country and abroad, being an honorary member of the Royal Society, in England as well as of the French Academy and of the Royal Academies of Russia and Germany. As a member of the National Academy of Sciences of America he served for many years as secretary and later as its vice-president. He received honorary degrees from many colleges and universities, amongst others the degree of LL.D. from Yale and the same degree from Harvard at the celebration of its two hundred and fiftieth anniversary.

Retiring from the Naval Observatory at the age of sixty-two, in accordance with naval regulations, Professor Hall continued his work for some years at the observatory in order to complete those matters upon which he was particularly engaged. For some years after he was in charge of the observatory at Madison, Wisconsin, and in 1896 became a member of the faculty of Harvard University with the title of professor of mathematics, which he retained until 1901.

Professor Hall's first wife, Angeline Stickney Hall, died in July, 1892. Of this marriage four sons survive. In October, 1901, he married Mary B. Gothier, of Goshen, Conn., who survives him.

Professor Hall numbered amongst his friends the leading scientific men of Europe and of America. His correspondence, running back for more than fifty years, would form of itself an interesting account of the astronomy of his day. He was in temperament, in devotion, in the simplicity and singlemindedness of his life, a true man of science. For him no distractions of social recognition or money-making served to withdraw his attention from the science to which he had given his life. No

man in our generation and in our country has given a better example of that true simplicity and sincerity which are the distinguishing characteristics of the highest type of the scientific life. Those of us who worked with him as students, as assistants, as colleagues, revere his memory not less for the simplicity and sincerity of his personal life than for the work he wrought for astronomy. His career is an illustration of the possibilities open to an American boy, and his life has shed luster upon his country and upon his science.

HENRY S. PRITCHETT

December 2, 1907

*THE LIFE AND WORK OF JOSEPH LEIDY*¹

THE statue just unveiled, of the late Joseph Leidy, reveals a most admirable portraiture of the greatest naturalist that this country, perhaps that any country, ever produced; for but few equalled, and none ever surpassed, Joseph Leidy in the exactness, variety and the comprehensiveness of his knowledge of natural history. Joseph Leidy, of French-German extraction, was born in this city, September 9, 1823, and died here, April 30, 1891. His whole life may be said to have been devoted to the study of natural history and was as simple, pure and noble as the objects of his lifelong study. Regarding with the spirit of a philosopher the petty incidents and annoyances that go to make up one's daily life, as only unavoidable interruptions to his life work, Leidy pursued the even tenor of his way. Happy in his domestic life, enjoying the society of his friends, generous and charitable, kindly and sympathetic to those with whom he came in daily contact, straightforward and honorable, incapable of deceit or of a mean or ungenerous thought or act, he lived his

life beloved by all, and passed away without having made an enemy during his long career. Such having been the life of our distinguished fellow citizen, his eulogist, as might be expected, will have no incidents to relate such as the lives of great generals, statesmen, men of affairs afford. Nevertheless, when perhaps the latter are forgotten, the name and reputation of Joseph Leidy will be preserved in the many and valuable contributions he made to our knowledge of natural history. Well might he have said like Horace "Exegi monumentum aere perennius." Leidy's early education was obtained at private schools. He studied medicine at the University of Pennsylvania, graduating as doctor of medicine in 1844. He at once began the practise of his profession to which he devoted himself for about two years. For some time Dr. Leidy experienced that struggle with hardships and obstacles incidental to the lives of so many young physicians, but it was happily relieved by his election in 1853, at thirty years of age, as professor of anatomy in the University of Pennsylvania. This position he held with the most distinguished success till his death, a period of nearly forty years. While Dr. Leidy was universally recognized as the leading teacher of human anatomy in this country, his text-book being long a classic, he himself viewed anatomy not simply as a means to an end, of practical value to the practitioner of medicine and surgery, but as constituting only a part of the general subject of morphology; that is, of the general structure of plants and animals. As an illustration of the manner in which Leidy studied the human body may be mentioned his treatise on the "Comparative Anatomy of the Liver" which work can still be studied with advantage by the medical student. With the means of a livelihood assured through his professorship at the university,

¹ Address delivered at the unveiling of the Leidy statue, October 30, 1907, City Hall Plaza, Philadelphia.